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Small pinning points increase grounding-line sensitivity

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Initialising prognostic simulations of outlet glaciers relies on geometry and surface velocity, from which data assimilation methods rectify poorly known parameters such as ice stiffness or basal slipperiness. Stemming from the contact between ice shelves and submarine topographic highs, pinning points impact both ice velocity and stiffness but, wherever they are small enough, they can easily be overlooked by satellite observations. Here, we use the ice-sheet model BISICLES to investigate the future ice dynamical behaviour of two neighbouring outlet glaciers in Dronning Maud Land, i.e. Hansenbreen and West Raghnild glacier. The latter is buttressed by a previously uncharted pinning point at the ice shelf front while both are separated by an ice promontory. We also reconstruct ice velocity and geometry fields including the pinning point, which is absent from Antarctic-wide datasets, from data collected on site. The model is initialised with three combinations of ice geometry and stiffness, (i) with or (ii) without the pinning point influence in the assimilation procedure, and (iii) being a variant of (i) but starting with unpinning. We explore two sub-ice shelf melting scenarios of three amplitudes, and two weertmann-type sliding law exponents for each initialisation. The results show the future unstable retreat of Hansenbreen, moderately affected by unpinning. However, ignoring the pinning point in data assimilation overstiffens the ice shelf and highly decreases the timing of the retreat. This study stresses the need of accurate bathymetry and ice velocity, as the current datasets that disregard pinning points tend to stabilise marine sectors of the East Antarctic ice sheet, hence affecting sea-level rise predictions.